programmable amplifier

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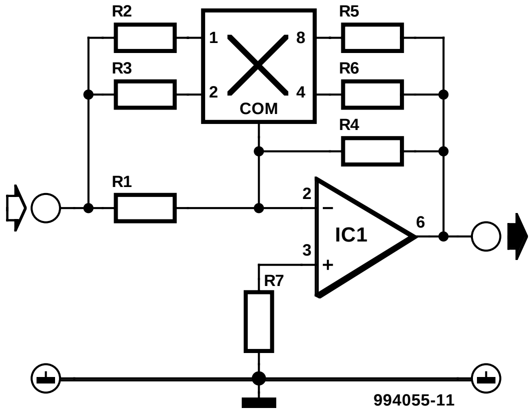

Table 2. Design example

R1, R4, R6 = 20 kΩ
R2 = 20 kΩ
R3, R5 = 30 kΩ

A = - (R4||R5||R6)/(R1||R2||R3)

Switch	Amplification
C	– 0.25
4	– 0.50
E	– 0.75
0	– 1.00
6	– 1.50
5	– 2.00
2	– 3.00
1	– 4.00
3	– 6.00

B. Schädler

One way of designing a programmable amplifier is placing a HEX-coding switch in the feedback loop of an operational amplifier (op amp). A 16-position coding switch has a mother contact, COM, and four binary coded outputs. Depending on the switch position, COM is linked to the relevant output.

Op amp IC_1 is arranged as an inverting amplifier with resistors R_1 and R_4 providing the feedback. These resistors are shunted by one or two resistors, as the case may be, by the coding switch. Each of the 16 ensuing combinations provides an amplification or attenuation factor as shown in Table 2.

The circuit as shown has a slight drawback: a changing input impedance. This means that in certain applications a buffer should precede the input. Bear in mind also that the resistor at the non-inverting input of IC_1 compensates for the input offset current and should therefore have a value that is comparable with that of the parallel combination of R_1, R_2, and R_3.

The switching may be augmented by replacing the coding switch by an analogue switch and operate this via a microcontroller.

[994055]

Table 1. Resistor shunting with a hex coding switch.

Switch position	Input resistance			Feedback resistance		
0	R1			R4		
1	R1||	R2		R4		
2	R1||		R3	R4		
3	R1||	R2||	R3	R4		
4	R1			R4||	R6	
5	R1||	R2		R4||	R6	
6	R1||		R3	R4||	R6	
7	R1||	R2||	R3	R4||	R6	
8	R1			R4||		R5
9	R1||	R2		R4||		R5
A	R1||		R3	R4||		R5
B	R1||	R2||	R3	R4||		R5
C	R1			R4||	R6||	R5
D	R1||	R2		R4||	R6||	R5
E	R1||		R3	R4||	R6||	R5
F	R1||	R2||	R3	R4||	R6||	R5